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VITAL HOLISTIC PHENOMENA AND PROPERTIES OF LIVING THINGS

With a focus on causal control from higher to lower levels, scientific theory can begin to recognize the natural vital forces of life which common sense has known all along.

ROGER SPERRY WITH COMMENTARY BY NORMAN COUSINS

DR. SPERRY: Early biologists hoped to find the secret to life in the form of special vital forces that distinguish the living from the nonliving, or the animate from the inanimate. When they started looking into living things, however, no special vital forces could be discovered. The longer, the harder, and deeper they looked, the more firmly biologists became convinced that there are no such things in this world as special vital forces. Instead, we concluded that all living things are nothing but physico-chemical processes in different forms and degrees of complexity, and that all life can be explained, in principle, by the laws of physics and chemistry. The idea that there exist any distinct "vital" forces came to be known as the doctrine of "vitalism" and by the 1930s had already become a subject of scorn and derision among nearly all biologists and remains so to this day.

What happened is that we biologists had been searching in the wrong places. You don't look for vital forces among atoms and molecules; you look instead among living things, for example among living cells and organisms acting and interacting as entities. You look, for example, among animals responding to each other, breathing, eating, running, flying, swimming, reproducing, nest building, etc. Among such actions and interactions of living things one finds plenty of evidence for vital phenomena, forces, laws, and properties that are not to be found anywhere among inanimate objects nor among the molecules of which the living are constituted. In other words, the special vital forces that distinguish living things from the nonliving are emergent, holistic properties of the living entities themselves. They are not properties of their physico-chemical components nor can they be fully explained merely in terms of physics and chemistry. This does not mean they are in any way supernatural or mystical. Those who conceived vital forces in supernatural terms were just as wrong as those who denied their existence. These higher, vital holistic phenomena and properties of living things are just as real, just as cause-effective and deserving of scientific recognition, as are the properties and laws of molecules or atoms, or electrons and protons.

When reductionist doctrine tried to tell us that there are no vital forces, just as it also had long taught that there are no mental forces, materialist science was simply wrong. Biological theory in this case was concentrating on the mass-energy of material components of living things and neglecting to appreciate the role of the nonmaterial space-time components which also are critical. In anything living or nonliving, the spacing and timing of the material elements of which it is composed make all the difference in determining what a thing is.

The nonmaterial space-time components, even

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when recognized, tend to be thrown out and lost in the reduction process, as science aims toward ever more elementary levels of explanation. If we think of things in terms of a mass-energy, space-time manifold, it can be seen that the space-time infrastructure gets shortchanged in our traditional mass-energy interpretations.

The modern molecular biologist is quite willing to recognize the power of chemical or molecular forces and to grant scientific respectability to the laws that describe their interactions, even recognizing the critical role played by the inner spatial and temporal configurations. When the entities are no longer molecules, however, but living organisms, the reasoning suddenly undergoes a flip-flop change.

For many decades, science has been teaching that we and our world are composed of nothing but aggregates of electrons, protons, and other subatomic elements. This overlooks the fact that it is the differential, nonmaterial spacing and timing of these elements, as much as the material elements themselves, that mainly cause the world to be what it is.

COMMENTARY: Dr. Sperry was referring just now to the microscopic level of subatomic particles where the nonmaterial spacing and timing of the particles makes a critical difference in determining exactly what a thing is. In nuclear physics and chemistry, for instance, internal space-and-time factors determine whether one is dealing with the ordinary element strontium, used in things like color TV tubes and crimson fireworks, or the extremely hazardous strontium-90, a radioactive isotope present in the fallout from nuclear explosions.

But similar factors apply at the macroscopic level of social interaction as well. Though it may sound trivial, it is precisely those nonmaterial elements of space and time at work in a complex system like freeway traffic that determine whether we have persons driving in a freely flowing pattern or persons being driven by clogged lanes and jams. Congested traffic prohibits one's freedom to move, change lanes, and travel at a self-regulated pace. Fluctuations of time and space have altered the "system" so much that a new system (the "traffic jam") has begun organizing itself, one that intensifies competition among the cars and substantially alters the reality of what exists on the freeway. The basic material elements of the two systems are the same: cars, drivers, asphalt, and concrete. But fluctuations in the nonmaterial elements of space and time have spawned something new (and for weary workers returning home, something exasperating!).

This new reality affects not only the external system of freeway traffic, but the psychological interactions of the drivers as well. In a traffic jam other drivers often become aliens who threaten our turf or enemies who need to be vanquished. Changes thus appear throughout all the interlocking systems, and new rules governing those systems emerge as well. This basically supports the point that new forces and laws may emerge which cannot be explained simply in terms of elementary natural laws. Is that why, Dr. Sperry, you've suggested that the lower level forces in any entity are enveloped, overwhelmed, and overpowered by the higher?

The special vital forces that distinguish living things from the nonliving are emergent, holistic properties of the living entities themselves.

DR. SPERRY: Yes, the point here is not only that new forces and new laws of the universe emerge at higher levels and that the higher cannot be fully explained or understood in terms of the lower, as has frequently been noted in the past—nor even that it is largely the new nonmaterial space-time factors as well as the material components, that determine the nature of reality.

The further point that changed all this story in the past decade, from the status of occasional philosophy and minority science to that of the practicing dominant doctrine in psychology, is the new stress on causation, for example, the idea that in the reciprocal interaction of lower and higher levels, the higher laws and forces (once evolved) exert downward causal control over the lower forces. The lower level forces in any entity are enveloped, overwhelmed and overpowered by the higher.

In scientific theory this means that the trajectories through space and time of most of the atoms on our planet are not determined primarily by atomic or

subatomic laws and forces, as quantum physics would have it, but rather are determined by the laws and forces of chemistry, of biology, of geology, of meteorology, of psychology, even sociology, politics, and the like. The molecules of all higher living things, for example, are not moved around in our biosphere so much by molecular laws and forces as they are by the living, vital powers of the particular species in which they are embedded. Such molecules are flown through the air, galloped across the plains, propelled through the water, etc., not by molecular forces (not by quantum mechanics) but by the specific holistic vital properties possessed by the organisms in question.

Much of this seemed a matter of common sense and direct observation until science came along and began telling us otherwise. Ever since, there has been a growing conflict of worldview between scientists and the rest of society. The conflict is felt most acutely among the humanities and especially among those disciplines most concerned with moral values. What we are saying here seems to be, in effect, an admission that the humanities and common sense were on the right track all along in these matters while we in science were misled.

The errors are now being corrected, however, and any differences in language, ideas, and beliefs that remain between scientists and the rest of society are not different in kind from those between two distant sciences. The profound conflict of worldview disappears.

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COMMENTARY: You seem to be saying, Dr. Sperry, that just when science thought it had the structure and behavior of the universe "figured out" through the laws of atomic chemistry and quantum physics, scientists like yourself began to suspect a wrong turn had been made. What moves the molecules of higher living things is not so much molecular laws and forces as "the living, vital powers of the particular species in which they are embedded." Your description of such molecules "flown through the air, galloped across the plains, propelled through the water" evokes a passage from Walt Whitman's "Song of Myself,"

> A gigantic beauty of a stallion fresh and responsive
> to my caresses,....
> His well-built limbs tremble with pleasure as we race
> around and return....

What determines the relation between horse and rider is ultimately neither their subatomic particles nor microscopic molecular events. The molecules of complex living organisms like horse and rider are moved by large macroscopic forces—mental intention, speed, friction, weight, human response and animal instinct—to say nothing of the skills and pleasures of equestrian sport. "New forces and new laws" emerge at higher levels of life, and "the higher cannot be fully explained or understood in terms of the lower."

But perhaps at this point some caution is to be recommended. To speak of nonmaterial vital powers or living forces that govern the operation of our evolving universe may convey the impression that the "new science" is in fact promoting a new species of mysticism or religion. There is, indeed, some recent literature which speaks rather mystically of an ultimate "cosmic essence"—charmed quarks or dancing energy—linked with what traditional religions have called "God." This literature relates the changes in worldview brought about by new discoveries in physics, chemistry and biology to theological speculation from both Eastern and Western sources. Would you be willing to comment on this phenomenon, Dr. Sperry, and to indicate how it differs from your own approach?

DR. SPERRY: Certainly. The changes in science and worldview that have resulted from research by me and my colleagues have to be distinguished from the sometimes similarly described—but actually quite different—renovations brought about by recent developments in theoretical physics, referred to in some places as the "new physics." In contrast to the

downward control concepts described here, the main theoretical change in physics adheres to the reductionist approach (reducing to component parts) and is concentrated on the nature of the ultimate particles of matter as cosmic essence, suggesting that these ultimate entities are not so particulate, not so separate as once thought, and are better described in probabilistic energy terms. These changed views of subatomic events have been very questionably extrapolated to the macroscopic realm as well by some writers, with analogies to Eastern religion and Taoism, inferring that macroscopic phenomena also are less material and machinelike than formerly supposed.

When physicists found that classical Newtonian laws didn't work any more for elementary particles but that a new theory, quantum mechanics, did work, they accordingly abandoned support for the old Newtonian doctrines in favor of the new quantum theory. The new theory was taken to be a more accurate and more comprehensive description of nature. I reject this on the ground that the subatomic properties, laws, and forces, regardless of their nature, are superseded by forces operating at higher macroscopic levels. There is no way quantum mechanics could replace classical mechanics for things larger than molecules. Quantum theory cannot handle the pattern factor that the classical laws naturally incorporate. Neither is wrong; we need both. But for different things. If our thinking is correct here, it is not legitimate to extrapolate from the nature of subatomic events to the world at large. The emergent entities at higher levels contain, envelope and control the properties and expression of the elementary particles. So the common world at the macroscopic level is better described in the framework of biology, geology, and the other sciences. The world is not all dancing energy or "charm" just because the ultimate building blocks seem to be of this nature.

Materialistic thinking commits similar errors, when in line with reductionist doctrine, it teaches that the forces and laws of the universe are blind, impersonal, purposeless, and uncaring. Among all the forces that impinge on mankind affecting our welfare and future, none is of more prominent and critical importance than the forces of human society by which we are surrounded and which, of course, are often personal, caring and replete throughout with purpose. The kinds of forces embodied in society, in family, friends, politics, legislation, urban development, and all the rest, including the expression of ethical, moral, and religious values, are all part of the natural order. Even below man, evolution as it progresses acquires a directionality and a complex self-built design with higher level controls that hardly fit the old mechanistic concept of a blind purposeless machine. Evolution can be viewed as a gradual emergence of increased purposefulness among the forces that move and govern living things.

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COMMENTARY: Two points are suggested by what Dr. Sperry has said. The first is that the attempt to extrapolate theological conclusions from developments in theoretical physics is mistaken because, among other reasons, the new physics adheres to the reductionist approach by seeking "ulitmate particles of matter" as the key to understanding all that goes on in our universe. Secondly, he suggests that the older materialist view in science falls from another direction into the same reductionist trap by teaching that the ulimate laws of the universe are uncaring and purposeless.

Against the view that evolution must result in mechanistic development or entropic disorder and loss of purpose, he proposes to define evolution as the simultaneous self-emergence of complex design and increased purposefulness among the realities that move and govern living things. This permits him to argue both that the universe is personal, caring, and purposeful, and that the forces embodied in such things as social life, politics, and religious values are all part of the "natural order." Such a position thus avoids both the reductionist trap and the dualistic supernaturalism which assigns such matters as ethical values, morals, and religious belief to a strictly other-worldly source.

A number of implications flow from Dr. Sperry's view. Ours is a universe of endless innovations and

creativity. And this is so not only for realities outside us, but also for our minds and consciousness. The mind constantly reorganizes itself, thrusts itself into new patterns that further enhance its potential for learning. Sometimes these shifts in the self-organizing mind may occur suddenly and dramatically, as when we are jolted into new awareness, flooded by new insight, or converted to an entirely fresh vision of the world and our role in it. Such changes are neither blind nor purposeless. They are in harmony with the larger evolutionary pattern of the universe itself, a pattern that is personal and replete with purpose.

DR. SPERRY: The point is that human nature and these higher kinds of controls in nature don't reduce any more to physical and chemical mechanisms, but have to be reckoned with now in their own form, in their own right. Vital, mental, social, and other higher forces, once evolved, become just as real as the evolved forces of molecules and atoms and must be given their due, over and above the elementary physical components. It will be evident that any theology that perceives God as equated with, or immanent in, the "laws and forces of the universe" comes out on these terms with a set of values and beliefs very different from those based in the traditional reductionist interpretations of materialist science.

The creative process in evolution involves control variables, forces and pressures operating at many different levels from the submolecular up to the ecologic, meteorologic, and even astronomic in that the sunlight, seasons, phases of the moon, tides, etc. are all ultimately involved. The whole process depends on genetic mutations at the molecular level and, although the physical chemist might not agree, we can concede with the French biochemist Jacques Monod that the genetic mutations are a matter of chance at least from biological perspectives. But this does not mean, as Monod and other reductionists infer, that the whole process and course of evolution is governed ultimately by chance.

Most of the "chance" mutations prove lethal and are disposed of, not at random but according to the ways they fit or don't fit into the developmental design of the species in question, itself a complex product of eons of evolution. Among the few mutations that survive the developmental constraints, there are many more "natural selection" pressures which control the further survival and fate of mutants that also are not matters of chance but products again of eons of acquired evolutionary design.

Among these higher selection pressures that include the competition for mates there are pressures at work that move the creative process toward ever improved, more competent, more attractive and more diverse life forms. Even beauty is selected for, as in mate preferences and in flower preference among pollinating birds and insects, etc. It is these higher laws and forces at the organismic, ecologic, and still higher levels that are in command in the creative process as much as or more than the events at the genetic level. It may all have started initially at the molecular level but as the process evolves, it incorporates space-time design, pattern and form factors at higher levels that, once established, become just as real and causal as those at the molecular level.

One can agree that the scientific evidence speaks against any preplanned purposive design of a supernatural intelligence. At the same time the evidence shows that the great bulk of the evolving web of creation is governed by a complex pattern of great intricacy with many mutually reinforcing directive, purposive constraints operating at higher levels, particularly. The "grand orderly design" is, in a sense, all the more remarkable for having been self-developed. To deprecate the higher emergent properties on the basis of their initial elemental building blocks is to further the error of materialistic thinking. ■

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